USAID FIRMS PROJECT

Sindhri Mango Export Market Marine Container Trial Shipments to the E.U.

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Data Page

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Abstract:

A detailed description of the protocols followed at the mango orchards and packinghouses during the preparation of the Sindhri marine container trial shipments to the Netherlands is provided below. The arrival quality of the fruit is described in detail, along with the comments of the importer on future market opportunities for Pakistani mangoes in the E.U.

The purpose of this report is to document in detail the steps followed in preparing the mango shipment and the resulting condition, appearance, and marketability of Sindhri mango fruit exported via refrigerated marine container to Europe.

Acronyms

CA	Controlled Atmosphere
CM	centimeter
IBF	pounds-force
KGF	kilogram-force
EU	European Union
USAID	United State Agency for International Development

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Executive Summary

Two GlobalGAP-certified farms in Sindh Province were the sources of the initial FIRMS-assisted Sindhri mango trial shipments to the E.U. by marine container. Each farm had recently completed their packinghouses and on-farm postharvest infrastructure. The fruit was harvested from each farm during the same 2-day period in mid-June (June 15-16, 2011). Each farm sent a 20-foot refrigerated marine container of Sindhri mangoes to Solfruit, a leading mango importer just outside of Rotterdam, Netherlands. The interval between harvest and fruit arrival at the warehouse of the importer was 21-22 days.

The Sindhri fruit in both marine containers arrived in good condition. However, considerable variability in fruit ripeness stage existed within most cartons. Individual fruit skin color ranged from fully green to entirely yellow, with a range of intermediate maturities in the same carton. Fruit flavor was very good and characteristic of the Sindhri cultivar. Pulp firmness was soft, which is also characteristic of the cultivar. The importer considered the lack of fruit firmness to be a significant quality defect and down-graded the overall quality rating of both marine containers to 3.5 (below average) on a scale of 1-5. This is largely due to the widespread availability of the very firm, but less tasty Keitt, Kent, and Tommy Atkins cultivar mangoes in the E.U. In the mainstream retail supermarket trade, firmness trumps flavor and skin color in the marketing of mangoes.

The green-skinned fruit continued to ripen and color normally during a 5-day period after arrival. The fruit had a very low incidence of postharvest decay, with about 3% of the total fruit infected with stem-end rot and 1% infected with anthracnose. The lack of postharvest decay was a very positive quality attribute of the Sindhri fruit. Postharvest fungal decay is one of the most common quality defects of mangoes worldwide. The fact that anthracnose and stem-end rot were of minor importance was very desirable from a fruit quality standpoint.

Although there were some issues with the physical integrity of the load, the overall results of the two Sindhri trial shipments were positive. The lack of fruit firmness was a concern to the importer, but the skin color and internal quality of the majority of the fruit was very good. The characteristic fruit softness would not be considered a quality defect among the Asian community consumers. The staff of Solfruit liked the fruit flavor and their ethnic market clients were very impressed with the Sindhri quality. In most cases, it was equal or better than what is sent by air from the various Karachi-based exporters. The arrival quality of the fruit and its continued normal ripening after arrival bodes well for the future market expansion of Sindhri mangoes in the E.U.

The E.U. and U.K. importers serving the mainstream retail supermarkets continue to be very interested in receiving Pakistani mangoes. However, among the mainstream retail supermarkets a firmer mango texture is preferred. Consumer education, in-store fruit sampling, market promotion, and value-added packaging are all needed to expose the

mainstream E.U. consumer to the excellent taste, but soft firmness, attributes of Pakistani mangoes.

The two successful marine container shipments of Sindhri mangoes to the Netherlands were a significant achievement for the Pakistani mango industry. They reinforced the assumption that Sindhri mangoes are amenable to transport by marine container to Europe. Also, the successful shipments provide solid evidence to growers, exporters, and importers that future larger volume export shipments of Sindhri mangoes to the E.U. are viable by marine container. A significant degree of confidence was attained for all stakeholders in the Pakistani fresh market mango export business.

1. Introduction

The objective of the USAID FIRMS Project mango trial shipments is to obtain a high percentage of marketable fruit for European importers serving the mainstream retail supermarkets using cost effective marine container transport.

In order to realize the above objective, the USAID FIRMS Project has provided grower training in good agricultural practices and has cost-shared in on-farm packinghouse equipment, cooling, and cold storage infrastructure.

The long term goal of the Project is to develop and expand the market volume and value for Pakistani mangoes in European retail supermarket channels. This will require growers and exporters to provide consistent supplies of high quality mangoes at a competitive price. Marine container transport mode is prioritized, due to the significantly greater export volume capacity and lower transport cost associated with sea freight.

2. The Trail Shipment

Mango Fruit Source

Two FIRMS Project-assisted trial sea shipments of 'Sindhri' mangoes to the E.U. were made in mid-June from Sindh Province. Two GlobalGAP-certified farms provided the fruit. The mangoes were grown at [redacted] in Tando Allayar and [redacted] in Sarkand-Nawabshah. The fruit from both farms was harvested over a 2-day period on June 15 and 16, 2011. Each farm had recently completed installation of the packinghouse equipment, blast chiller, and cold storage.

Figure 1: Conveyor feeding belt and washing unit (left), hot water submergence tank (center), and blast chiller (right) were used to prepare the trial shipment fruit.

Fruit Harvest Maturity

The fruit was harvested in the firm green stage, with a Brix content ranging from 5.5 (inside of tree canopy) to 6.8 (outside of tree canopy). The fruit pulp color was cream to light yellow.

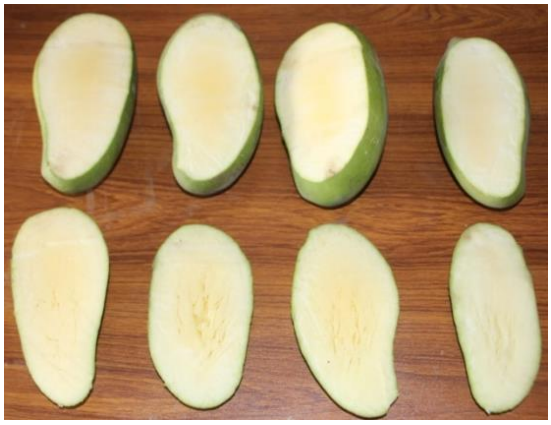

Figure 2: Cream to light yellow pulp color of Sindhri fruit at harvest.

Harvest Conditions

The outside ambient temperature during fruit harvest in Tando Allayar ranged from 30-34° C, with a 70 % relative humidity. The average internal pulp temperature of the harvested fruit was 32° C. The ambient temperature was several degrees higher in Sarkand-Nawabshah. There had been no rainfall prior to or during harvest in either of the locations.

Harvesting Process

The fruit were carefully harvested using secateurs and picking poles and put into well-ventilated rigid plastic field containers. Approximately 5-7 cm of pedicel (stem) was left attached to the fruit.

Figure 3: Manual fruit harvesting practices (left, center) and rigid plastic field container (right).

De-sapping

The majority of fruit were manually de-sapped in the field, under the shade of the mango trees. The stem was re-cut near the shoulder of the fruit, while held in an inverted position. The fruit was placed stem-end down on metal de-sapping racks and left to de-sap for approximately 3 hours.

Figure 4: Manual de-sapping of Sindhri mangoes.

The remaining portion of the fruit was de-sapped by submerging the fruit in a tank of lime (0.5 % calcium hydroxide) for about 30-seconds immediately after severing the pedicel. The fruit was then transferred to a tank of clean water for another 15-second in order to remove the film of lime from the fruit surface.

Packinghouse Operations

After de-sapping, the fruit were put back into the rigid plastic field containers and brought to the packinghouse. The mangoes were carefully unloaded by tilting the field container so the fruit could roll onto the slowly moving receiving conveyor belt. Preliminary sorting/grading was done to remove the non-export market quality fruit. The fruit were then cleaned on top of a series of rotating brushes and overhead spray wash water. The fruit continued along the packing line and into a hot water tank maintained at 52° C ±0.5° C. The majority of fruit received a 5 minute hot water submergence treatment to minimize the incidence and severity of postharvest fungal decay. The fruit then were dried by passing over a series of rotating sponge rollers and through a forced-air drying tunnel. The surface dried fruit then moved into a collection area where it was manually sorted, graded, and packed in 4-kg open-top corrugated cartons. A single layer of uniform-sized fruit was packed into each corrugated carton, which was manufactured by [redacted] in Dubai.

Figure 5: Unloading (left) and manually packing (center) of mango fruit into 4-kg open-top cartons (right).

The cartons were weighed, stacked on pallets, secured with 4 cornerboards nailed to the base of the wooden pallet, strapped tightly around multiple layers of cartons, and moved with a hand jack into the blast chiller maintained at 12° C. Each pallet contained 144 cartons, consisting of 16 layers and 9 cartons per layer (3 x 3 configuration). The same size fruit were stacked on a pallet, with the count per carton ranging from 6 (large size) to 12 (small size). The majority of Sindhri fruit from [redacted] Farm was large, while the majority of fruit from [redacted] was small.

Figure 6: Carton weighing (left), pallet formation (center), and blast chilling (right) of mangoes.

The pallets were left in the blast chiller until the pulp temperature reached 12-13° C. This required between 4-5 hours, depending on the number of fruit loaded into the blast chiller. After cooling, the pallets were moved into the adjacent cold storage room, also maintained at 12-13° C. The pallets remained inside the cold storage room for approximately 1 day, until loading into the marine container.

Marine Container Loading

Each 20-foot marine container contained 12 pallets. There were 1,728 cartons per 20-foot marine container, for a total fruit weight of approximately 7 metric tons. The pallets were center-loaded into the marine container, with a small gap between the inner metal wall of the marine container and the outer wall of the pallet. Makeshift bracing material consisting of pieces of Styrofoam and cardboard was stuffed into the gap areas to minimize pallet shift during transit. Due to warm air influx into the marine container

during loading, the fruit temperature rose several degrees. The loading dock door was not able to be sealed tightly, which allowed significant amounts of warm air to enter. Also, the physical process of loading the 12 pallets into the marine container was slow and cumbersome. The entire marine container loading process took 3-4 hours. After the pallets were loaded into the refrigerated marine container, the rear door was sealed and the container was transported to Port Qasim.

Figure 7: Manual loading of pallets by hand jack into the 20-foot marine container.

Inland Transport

The marine containers filled with mangoes left both farms at approximately the same time, which was around 2 a.m. Friday, June 17. [redacted] was the freight forwarder and [redacted] was the commercial exporter. The marine containers were equipped with a Genset to maintain refrigeration during over-the-road transport. Upon arrival at the Maersk Lines container staging facility outside of Port Qasim, the containers were plugged into the electrical power source to maintain refrigeration during the brief holding period. The containers were then loaded onto the deck of the departing vessel, which left from Port Qasim on Saturday, June 18. The internal temperature of one container was set at 12° C, while the other was set at 13° C. This slight difference in shipping temperature between the two marine containers was done to help determine the optimal transport temperature for Sindhri mangoes.

Figure 8: Arrival (left) and departure (right) of the refrigerated 20-foot marine container used to transport mangoes from the on-farm packinghouse to the Netherlands.

Marine Container Transport

The two marine containers were put on the same Maersk Lines feeder vessel, which arrived in Salalah, Oman on Monday, June 20. The containers were transferred onto a larger vessel ('Maersk Madrid') which departed Wednesday evening, June 22 at 11 p.m. The vessel arrived in the Port of Rotterdam late in the evening of Wednesday, July 6. The total duration of sailing from Port Qasim to Rotterdam was 19 days. The two marine containers were cleared from the Port the following morning and transported to nearby Barendrecht, Netherlands, arriving at Solfruit during the mid-morning hours of Thursday, July 7. The containers were unloaded from the marine container with a forklift and staged in the refrigeratated (10° C) receiving warehouse of Solfruit. The interval between harvest and fruit arrival at the warehouse of Solfruit was 21-22 days. Temperature data from the recorders place in each container indicated the internal temperature was 15° C during the entire voyage in both containers. This was 2 degrees higher than desired.

Significant load shift and pallet movement occurred inside the marine container during transport. This resulted in damage to many of the cartons and loss of pallet structural integrity. The pallets were leaning noticeably to one side and the strapping material was not tightly securing the cartons. The makeshift bracing material was of minimal benefit in stabilizing the load.

Figure 9: Lower carton collapse (left) and pallet shifting during transit required re-stacking of all the cartons at the Solfruit warehouse (right).

Fruit Arrival Quality Condition

The Sindhri fruit in both marine containers arrived in generally good condition. There was no significant difference in fruit arrival quality between the two farms. Occasional surface scarring and fruit bruising occurred, but was mostly confined to the cartons which had collapsed. Sapburn stains were observed on about 15 % of the fruit in each container, which was high. However, most of the sapburn was confined to the immediate area around the stem and did not result in fruit decay.

Significant variability in fruit ripeness stage existed within most cartons. Individual fruit skin color within a carton ranged from fully green to entirely yellow, with a range of intermediate maturities all in the same carton. Green-skinned fruit is not considered a quality defect among the mainstream retailers, but it is a quality defect in many ethnic shops, whose clients prefer a partially or fully yellow skin mango.

Fruit flavor was very good and characteristic of the Sindhri cultivar. Pulp firmness was soft, which is the genetic characteristic of most Pakistani mango cultivars. The importer considered the lack of fruit firmness to be a significant quality defect and down-graded the overall quality rating of both marine containers to 3.5 (below average) on a scale of 1-5. Both marine containers had similar quality fruit. Primarily due to the fruit softness, both loads were rated below average and the quality report would have to be considered as a claim. This is largely due to the widespread availability of the very firm, but less tasty Keitt, Kent, and Tommy Atkins cultivar mangoes in the E.U. In the mainstream retail supermarket trade, firmness trumps flavor and skin color in the marketing of mangoes.

The pulp color of most of the Sindhri fruit was a uniform deep yellow. Uneven “egg-yolking” of the flesh was observed in approximately 20 % of the fruit, but was minor in the degree of severity and not a significant quality defect.

The incidence of postharvest decay (anthracnose and stem-end rot) was very minor and resulted in about a 4 % loss of marketable fruit. In addition, anthracnose and stem-end rot did not increase during the 5-day ripening period after arrival. The low incidence of postharvest decay was a very positive quality attribute of the Sindhri fruit. Postharvest fungal decay is one of the most common quality defects of mangoes worldwide. The fact that anthracnose and stem-end rot were of minor importance was very desirable from a fruit quality standpoint. These fungal diseases infect the fruit during pre-harvest growth and development on the tree, but generally remain dormant until the fruit begins to ripen after harvest. Both diseases are accentuated by rainfall prior to and during harvest. These two diseases are widespread in Pakistan and commonly found on domestically marketed mango fruit. The very low incidence and severity of postharvest decay on the Sindhri mangoes was favored by the absence of rain during fruit growth and development and the generally low RH conditions in Sindh Province. In addition, no rainfall occurred prior to or during harvest.

Although there were some issues with the physical integrity of the load, the overall results of the two Sindhri trial shipments were positive. The lack of fruit firmness was a

concern, but the skin color and internal quality of the majority of the fruit was very good. The staff of Solfruit liked the fruit flavor and their market clients were quite impressed with the Sindhri quality. In most cases, it was equal or better than what is sent by air from the various Karachi exporters. The very low amount of postharvest decay and the continued normal fruit ripening and yellow skin coloration after arrival bodes well for the future market expansion of Sindhri mangoes in the E.U. using marine container transport. The characteristic fruit softness would not be considered a quality defect among the Asian community consumers. However, among the mainstream retail supermarkets a firmer mango texture is preferred. Consumer education, in-store fruit sampling, market promotion, and value-added packaging are all needed to expose the mainstream E.U. consumer to the excellent taste, but soft firmness, attributes of Pakistani mangoes.

Figure 10: External appearance of Sindhri mangoes upon arrival in the Netherlands, 21-22 days after harvest

Figure 11: Internal appearance of Sindhri mangoes upon arrival in the Netherlands, 21-22 days after harvest

Firmness

Considerable ripening of the mango fruit occurred following harvest and during transit. The pulp texture changed from very firm at harvest to soft upon arrival. The average penetrometer firmness of the fully green-skinned fruit upon arrival was 3.7 lbf (pounds-force) (1.7 kg-force) using a 16 mm tip. The average firmness of the more ripe fully yellow-skinned fruit was 1.4 lbf (0.6 kg-force). The flesh firmness of the Sindhri mangoes continued to progressively soften during the 5-day post-arrival period.

The soft fruit texture was not desired by the importer, since the fruit requires an additional week to be distributed and marketed by their retail clients. In addition, the vast majority of competing mangoes exported to Europe (primarily the varieties Keitt, Kent, and Tommy Atkins) have a very firm texture, ranging between 10-14 lbf. These firm varieties are the standards for comparison when selling mangoes to the mainstream E.U. supermarkets. Supermarkets have traditionally only stocked very firm mangoes. However, tastes are changing and consumers are interested in diversifying their mango eating experiences. Consumer education will be needed to familiarize Europeans with the highly desirable flavor of Pakistani mangoes, along with their less firm texture.

The 15° C internal marine container temperature accelerated the rate of ripening and concomitant fruit softening relative to the desired 12° and 13° C temperature. Better temperature control would have provided a firmer fruit upon arrival.

Figure 12: Soft textured Sindri mangoes with a pulp firmness reading of 3.7 lbf for green skinned fruit (left) and 1.4 lbf for yellow-orange skinned fruit (right).

Sugar Content

The sugar content of the Sindhri mangoes increased from the at harvest range of 5.5-6.8° Brix (% sugar) to an average of 14.9° for the full green-skinned fruit upon arrival. The more mature half-green/half-yellow skinned fruit had an average Brix reading of 17.5°, while the ripe full-yellow skin colored fruit had an average Brix reading of 19.0° upon arrival. The fruit were ready-to-eat, whether green-skinned or yellow-skinned, and the flavor was very good.

Figure 13: Hand-held digital refractomer used to measure °Brix (% sugar) of mango fruit.

Overall Fruit Quality Characteristics

The overall fruit quality of the Sindhri mangoes was monitored upon arrival and 3 and 5 days after arrival at a holding temperature of 10° C. There were no significant differences in the quality parameters between fruit from the two different farms. Each marine container load arrived in very good condition and the fruit remained in similarly very good condition during the 3 and 5 day holding period after arrival. The fruit continued to slowly ripen during the 3 and 5 day period after arrival. There was no noticeable loss in fruit market quality during the 5 day holding period. In addition to the overall appearance and condition observations, a total of 40 randomly selected fruit were analyzed from each sampling period for firmness and Brix (% sugar). A summary of the overall fruit quality parameters and the average fruit firmness and sugar content readings are shown in the table below. The fruit were obtained from the cartons which had been manually de-sapped and hot water treated (5 minutes at 52° C).

Table 1: Overall Fruit Quality of Sindhri Mangoes at Arrival and 3 and 5 Days Post Arrival

Quality Parameter	At Arrival	+ 3 Days	+ 5 Days
Skin Color	ranged from all green to all yellow	ranged from green-yellow to all yellow	ranged from yellow-green to all yellow
Fruit Firmness (lbf)	3.0	2.7	2.5
Pulp Temperature	15° C	10° C	10° C

Brix (% sugar)	16.9	17.2	17.4
Pulp Color	yellow	yellow	yellow
Postharvest Diseases			
Anthracnose	1%	1%	1%
Stem-end rot	3%	3%	3%
Defects			
Soft Nose	1 %	1 %	1 %
Jelly Seed/Egg Yolking	20 %	20 %	20 %
Vivipary/Seed Germination	0 %	0 %	0 %
Color Blotches/Mosaic	10 %	10 %	10 %
Abrasions/Bruises	10 %	10 %	10 %
Shriveling/Moisture Loss	5-9 %	5-9 %	5-9 %
Physical Damage	10 %	10 %	10 %
Organoleptic Acceptability	very good	very good	very good
Hedonic Scale	7 out of 10	7 out of 10	7 out of 10
Total Marketable Product	90 %	90 %	90 %

Experimental Postharvest Treatments

A number of different postharvest treatments were administered at the packinghouses in Sindh to determine the optimal postharvest care treatment. Fruit from the experimental cartons were analyzed for peel coloration, postharvest decay, overall fruit condition, sugar content (i.e. °Brix), and firmness. The different posthavest treatments tested included manual versus lime wash de-sapping and different lengths of hot water sumergence for postharvest fungal disease control (i.e. 3,5, and 8 minutes at 52° C and 3 minutes at 54° C hot water submergence). The fruit quality from the different treatments was monitored over a 3 and 5 day holding period following arrival.

Figure 14: The wide range in fruit maturity in each carton masked any postharvest fruit quality difference between treatments.

There were no significant differences in external or internal fruit quality between the different experimental postharvest treatments. The fruit external appearance, internal appearance, firmness, rate of ripening, and incidence of postharvest decay was similar between all treatments. It was not possible to identify one or more superior (or inferior) postharvest treatments. There was no difference in the rate of fruit ripening between the different hot water treatments. Also, there was no damage observed on the Sindhri mangoes from any of the hot water treatments.

Figure 15: Representative cartons of fruit from the different postharvest treatments.

3. Constraints Impacting Fruit Arrival Quality

Several constraints existed in both marine container shipments which had a negative impact on the arrival quality of the mango fruit. These constraints will have to be alleviated in order to provide the E.U. importers with the consistency and quality of fruit they require.

Pallet Construction

The surface of the wooden pallets which supported the stack of 4-kg corrugated cartons had relatively wide gaps between the parallel wood boards. These gaps or spaces between the boards did not provide support for the ends of some of the cartons. As a result, the weight of the cartons from above caused the lowest layer(s) of cartons to collapse. The problem was observed during cold storage on the farm, but became increasingly problematic during transit. Upon arrival in the Netherlands, all of the pallets had significant carton collapse and breakdown of the physical integrity of the 16-carton high stacked pallet. Some of fruit in the damaged lower cartons suffered severe bruising and physical injury. All of the pallets in each marine container had to be re-stacked in order to remove the damaged lower cartons. This was a very costly exercise, as manual labor wages for this type of work in the Netherlands average 16 € per hour.

Recommendation

The problem of carton collapse due to the wide spacing between surface boards can be resolved by adding more surface boards to the pallet and limiting the gap between boards to be no more than 1 cm wide. A very close spacing between surface boards on all pallets must be used in all future marine container shipments. In addition, a stronger and more graphically attractive 4-kg open-top carton is desirable.

Figure 16: Widely spaced boards on the pallet surface resulted in carton collapse immediately after palletization (left, center). Carton collapse became worse during transit, resulting in multiple losses of cartons upon arrival in the Netherlands (right).

Bracing Material Inside the Marine Container

The problem of carton collapse was accentuated by the lack of adequate bracing or support material between the inside wall of the marine container and the outside wall of the pallet. The pallets should be centered-loaded inside the marine container for proper internal air circulation during transit. Therefore, a small gap will remain between the inside container wall and the outer wall of the pallet. This gap or space is usually around 4 inches (10 cm) in width. Bracing or support material must be put in this gap so each pallet does not move sideways and the stacks of cartons do not lean as the marine container sways during ocean transit. If there is enough lateral movement of the marine container and there are no braces to fill the gaps between the pallets and container wall, the pallets may rock against the container wall, which is highly undesirable.

Recommendation

The problem of pallet shift during transit and the concomitant carton damage due to inadequate bracing or pallet stabilization can be quite easily resolved. Typically, strips of some type of solid foam material (i.e. Styrofoam), or pillow packs are used as bracing materials. They should be about 4 inches thick, 1.5 feet wide, and 2-3 feet tall. Each of the 12 pallets in a 20-foot marine container should have a brace for vertical support.

Weight Loss and Peel Shriveling

The amount of weight loss per carton was high during transit. This can be largely attributed to the lack of humidity control inside the marine container. The gross weight of the corrugated cartons ranged between 4.1-4.3 kg at the time of packing. Upon arrival in the Netherlands, the gross carton weight ranged between 3.1-4.0 kg. The empty carton weight was 0.3 kg.

Figure 17: Significant fruit weight loss occurred during transit; with the final gross carton weight falling well below 4.0 kg.

Supplemental humidification inside the marine container would have prevented much of the weight loss. Unfortunately, the two 20-foot marine containers used in the trial shipments did not have a humidifier inside. Humidity control inside the marine container

to maintain a 90 % relative humidity (RH) during transit would have helped reduce much of the weight loss. Due to the high amount of moisture loss in transit, Solfruit had to market the cartons as having only 3-kg net weight of fruit. In order to be able to rapidly sell the soft-textured fruit, their 3-kg carton list price (f.o.b. Barendrecht) to interested clients was 3 €.

Shriveling of the peel was apparent on many of the fruit due to excess dehydration and the lack of supplemental humidification during transport.

Recommendation

Mango fruit should be transported with an internal marine container atmosphere of 90 % RH, ±5 %.

Figure 18: Fruit shriveling and peel desiccation was noticeable on multiple fruit upon arrival.

Sapburn

The majority of the mango fruit harvested at both farms was manually de-sapped and the severed stem was left to dry in the open air on de-sapping racks. Nevertheless, a significant amount of sapburn on the skin of the fruit was noticed upon arrival in the Netherlands. This may be attributed to inadequate de-sapping time in the field and/or improper orientation of the fruit on the de-sapping racks. In some fruit, it was observed that the cut stem was not properly oriented in a vertical upside-down position, which allowed for some sap to come in contact with the peel.

Recommendation

Closer supervision of the field workers and strict adherence to the vertical upside-down orientation of the fruit are necessary while cutting the stem and de-sapping the fruit. Longer de-sapping times in the field are needed to ensure all of the latex has stopped exuding from the severed stem prior to moving the fruit to the packinghouse. Also, a slightly longer stem stub will help to reduce the amount of sap flow.

Figure 19: Improper or incomplete de-sapping results in latex exudation from the severed stem onto the fruit skin, causing noticeable blemishes (left, center) and anthracnose decay (right).

4. Conclusion

Although there were some issues with the physical integrity of the load, the overall results of the two Sindhri trial shipments were positive. The lack of fruit firmness was a concern to Solfruit for marketing the mangoes to the mainstream supermarkets, but not to the stores which target Asian community consumers.

The skin color and internal quality of the majority of the fruit was very good. The staff of Solfruit liked the fruit flavor and their ethnic market clients were quite impressed with the Sindhri quality. In most cases, it was equal or better than what is sent by air from the various Karachi exporters. The arrival quality of the fruit and its continued normal ripening after arrival bodes well for the future market expansion of Sindhri mangoes in the E.U.

A 21-day or less transit time from Port Qasim to Rotterdam (or another E.U. arrival port) is strongly recommended in order to have a reasonable chance at success in sending Pakistani mangoes by marine container to the E.U. The total time period from fruit harvest in Pakistan until consumer purchase of the mangoes at the retail supermarket should not exceed 30 days. However, if a CA container is used for transport, an additional week of market life may be possible.

The E.U. and U.K. importers serving the mainstream retail supermarkets continue to be very interested in receiving Pakistani mangoes. The two successful marine container shipments of Sindhri mangoes to the Netherlands were a significant achievement for the Pakistani mango industry. They reinforced the assumption that Sindhri mangoes are amenable to transport by marine container to Europe. Also, the successful shipments provide solid evidence to growers, exporters, and importers that future larger volume export shipments of Sindhri mangoes to the E.U. are viable by marine container. A significant degree of confidence was attained for all stakeholders in the Pakistani fresh market mango export business.

5. Annexes

The fruit quality reports made by Solfruit upon arrival of the marine containers is shown below.

Annexure 1. Solfruit Arrival Quality Report ([redacted]

Solfruit international

FRUIT CONDITION REPORT – RECEIVED BY SOLFRUIT INTERNATIONAL BV

CONSIGNMENT INFORMATION

Date of arrive	07-07-2011	**Reference Solfruit**	PTN-10-002709
Supplier:	*Firm*	**Vessel:**	Maersk Madrid
Container:	MWCU 580070-0	**Ryan Recorder 1614697**	With respect to the transit temperature we can report that a Ryan recorder not had been placed in the container
Product:	Mangoes Origin Pakistan	**Variety:**	*Sindhri*
Brand(s):	*Hyder Shan fruit Farm*	**Category**	Cat I
Amount of pallets:	12	**Amount of cartons**	1728
Amount of inspected pallets:	12	**Amount of inspected cartons**	60

TEMPERATURE & PACKING INFORMATION

Pulp Temperature	Between 13.4 and 14.9 degrees	**Packaging**	Open top cartons
Ryan Temperature	15 degrees celcius	**Palletizing Bad**	The cartons had been loaded on one way wooden pallets. The pallets had been strapped by means of vertically applied straps
Transport claim		**Gross Weight per carton**	4 kg
Size	6-7-8-9-10 ers	**Tarra**	360 gram
Growers	Hyder Shan Fruit Farm	**Nett Weight per carton**	6er = 3.53-3.70 7er = 3.06-3.53 8er = 3.43-3.48 9er = 3.53-5.55 10 = 3.41-3.68

PRODUCT OBSERVATION

Texture consistency	Sensitive to soft
Ripeness & Maturity	Ripe very ripe lbs pressure form 0 to 4 lbs
Brix Readings	16.3% to 18.2%
Eating Quality	Good ready to eat
External Colour	Greenish yellow undertone to yellow
Internal Colour	Yellow
Internal Defects	Not found
External Defects	We unpacked and inspected contents of a representative number of cartons taken at random and we noted as follows : Resin skin damage 15% Scab 8% Bruising 22% bottom layers
Decay	Yes 3% Stem –end rot 15% pressure decay in the bottom layers from the pallets

CONCLUSIONS

Quality Score (from 1-5)	.3/4
Necessary Actions	• The consignment has to be claim by the supplier for decay and ripeness. • Remark has to be make for space between the pallets and frond of the container all the pallets

are slanting. • Different pallets has mould and all the pallets bottom layers are damage. • All the pallets has to be repack and marketed on rapid way because the ripeness. • Pictures included.

1= Excellent
2= Good
3= Regular (part of the consignment is showing problems, quality report has to be considered as a (partial) claim)
4= Poor (the entire consignment is showing serious problems, quality report has to be considered as a claim)
5= Total Loss (the consignment has to be destroyed, quality report has to be considered as a claim)

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Annexure 2. Solfruit Arrival Quality Report [redacted]

FRUIT CONDITION REPORT – RECEIVED BY SOLFRUIT INTERNATIONAL BV

CONSIGNMENT INFORMATION

Date of arrive:	07-07-2011	**Reference Solfruit:**	PTN-10-002709
Supplier:	Firm	**Vessel:**	MAERSK MADRID
Container:	PONU 292652-6	**Ryan Recorder:**	16164687
Product:	Mangoes Pakistan	**Variety:**	Sindhri
Brand(s):	Various	**Category**	Cat I
Amount of pallets:	12 pallets	**Amount of cartons**	About 1728 boxes
Amount of inspected pallets:	12 pallets	**Amount of inspected cartons**	85 boxes

TEMPERATURE & PACKING INFORMATION

Pulp Temperature	14,3 to 19,2 degrees Celsius. The temperature for mangoes is too high.	**Packaging**	Open top cartons
Ryan Temperature	15 degrees Celsius	**Palletizing**	Bad (all the pallets was slanting, bottem layers damaged, because it was too many space between the pallet and the doors. We don't found any label on the boxes with the sizes. The boxes in the middle of the pallets, are without any label with variety – sizes- produce of ..... It's important.
Transport claim:		**Gross Weight per carton**	4 kg
Size:	6er – 7er – 8er – 9er - 10er	**Tarra**	360 gram
Traceability Code:	15204611 / 15205611 15202611 / 15203611 15201611	**Nett Weight per carton**	Average is 3,50kg underweight
Farm:	Murtaza Agriculture Farms		

PRODUCT OBSERVATION

Texture consistency	Sensitive to soft Average is soft
Ripeness & Maturity	Ripe very ripe (pressure lbs= 0 to 4 lbs)
Brix Readings	16,1% - 17,1% - 19,2% - 18,3% - 14,3%
Eating Quality	Good (ready to eat)
External Colour	Greenish yellow undertone to yellow
Internal Colour	Yellow
Internal Defects	Not found during inspection
External Defects	• Resin skin damage 10% to 25% (dangerous for more % stem end rot) • Mould on the stem end slight 5% • Scab 8% • Bruising slight 10% heavy 5%

	• Dry sensitive skin 3% to 5%
Decay	Yes, 1% to 2,5% Stem –end rot

CONCLUSIONS

Quality Score (from 1-5)	3 / 4 (because the ripeness – skin defects and decay)
Necessary Actions	The consignment has to be claim by the supplier for decay – skin defects and ripeness. Different pallets has mould and all the pallets bottom layers are damage. All the pallets has to be repack and marketed on rapid way because the ripeness. Pictures included.

1= Excellent
2= Good
3= Regular (part of the consignment is showing problems, quality report has to be considered as a (partial) claim)
4= Poor (the entire consignment is showing serious problems, quality report has to be considered as a claim)
5= Total Loss (the consignment has to be destroyed, quality report has to be considered as a claim)

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